Corona Testing of Devices Used to Mitigate Bird Collisions

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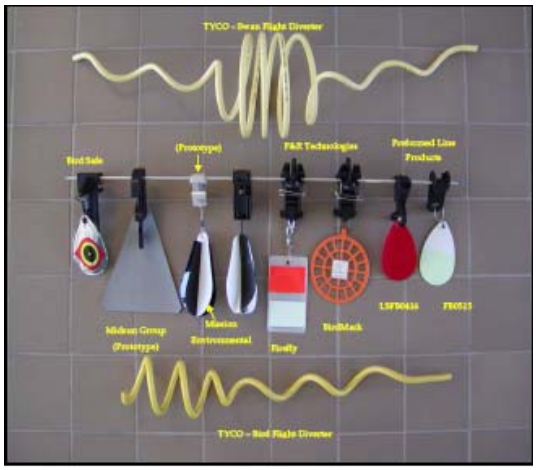
Electric corona occurs when the voltage of a conductor is raised to a threshold where the surrounding air is ionized and becomes a conductor. Power line corona is most likely to occur from sharp edges on energized hardware, broken conductor strands, or defective insulators.

The Issue

Bird deaths resulting from collision with power lines are a violation of the Migratory Bird Treaty Act and can result in federal fines. Accordingly, utilities often mark wires in flight paths with various devices to make the power lines more visible to birds. Although these "flight diverter" devices are effective in reducing avian collisions, they can also cause electric corona, which can result in audio noise (AN) or radio interference (RI). Because corona may lead to customer complaints, it is important to know how marking power lines might influence corona.

Project Description

This project sought to determine whether various flight diverters could be used on energized wires—at typical transmission voltages—without creating significant corona discharge. The research team tested ten commercially available devices at simulated 115 kV, 230 kV, and 345 kV phase-to-phase line voltages. The corona produced by each device at each voltage was measured with a DayCor II camera, which detected the ultraviolet light associated with corona discharge.



Flight diverters tested in this project. TYCO's Swan Flight Diverter and Bird Flight Diverter appear at the top and bottom, respectively.

In addition to testing flight diverters, researchers tested the Bird Strike Indicator (BSI) for corona. The BSI is an impulse-based sensor (developed in a separate Energy Commission project) for remote detection and recording of bird strikes. Flight diverter testing created an opportunity to test the BSI at no additional cost.

PIER Program Objectives and Anticipated Benefits for California

This project offers numerous benefits and meets the following PIER program objectives:

- **Providing reliable energy.** This project gives biologists and engineers the information they need to determine the voltage of wires they can mark without creating unacceptable levels of audio noise or radio interference. It also lends insight into designing flight diverters to avoid corona discharge.
- **Providing environmentally sound energy.** This project gives valuable information regarding specific products that can reduce avian mortality without engendering customer complaints about audio noise or radio interference.

Results

Below 115 kilovolts, all the devices were suitable from an AN and RI perspective. The best-performing devices at 115 kV were the Bird Flight Diverter and the Swan Flight Diverter, neither of which had any detectable corona discharge. At 230 kV, the coil-type Bird Flight Diverter and the Swan Flight Diverter had a medium level of corona, but still outperformed the flapper-type diverters, which tended to develop corona at the point of attachment to the conductor and at the top of the flappers. At 345 kV, all devices had very high levels of corona.

Note that audio noise and radio interference generated on lines above 115 kV does mean these diverter devices cannot be used. Such devices may be installed in areas that will not elicit complaints about AN or RI.

At or above 115 kV, corona may hasten material degradation, resulting in premature failure. Before installing a specific type of device, utilities should gather sufficient test data to know if the proposed device can withstand the long-term effects of corona. Other device selection criteria include product effectiveness for particular bird species, capital and installation costs, durability, aesthetics, and the effects on ice and wind loading.

Final Report

The final report for this project is posted on the PIER Web site at:
http://www.energy.ca.gov/pier/final_project_reports/500-04-086.html.

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